Utilization of fiber should have a fill factor much higher than SWBT proposes. As electronics can be added to increase capacity on fiber, a fiber segment of the loop should almost never reach its capacity. Staff acknowledges that SWBT should be allowed to set some fiber strands aside for administrative and breakage purposes. As a result of the fact that the capacity of fiber is enormous, and for reasons such as 100% FDI placement and shorter asset lives, Staff believes that the proposed 85% fiber feeder fill is appropriate

V. Feeder Stub - SWBT uses a fill factor of **______** for the feeder stub segment for all geographic zones. Feeder stub is the copper facility which connects the DLC equipment to the FDI. Because feeder stub is part of the feeder plant, fill should be the same as that used in the feeder facility. For this reason, Staff recommends an 85% fill factor for feeder stub.

VI. DLC - In matters concerning the DLC equipment, SWBT utilizes a fill factor of **______**. As stated previously, DLC is a piece of multiplexing/demultiplexing equipment that is housed in a remote terminal at the end of a feeder facility. DLC equipment does not need to have a large amount of spare capacity, as the existing capacity can be increased due to its modularity. Specifically, additional line cards can be added to the DLC to increase capacity. The DLCs' modularity certainly warrants a fill factor higher than that proposed by SWBT. In light of these considerations, Staff recommends an 85% fill on DLC equipment. Staff believes this allows sufficient capacity for administration and breakage while still recognizing the modularity of the equipment.

Distribution to Code Percentages - SWBT used its existing distribution to code instead of a forward-looking distribution to code. The distribution to code identifies the percentage of aerial, buried, underground cable for each type of cable placement. SWBT is currently replacing as much aerial copper feeder as possible with buried copper feeder cable in its network. In addition, SWBT does not use any aerial fiber in its existing network and will not use aerial fiber on a forward-looking basis. To reflect this conversion, it seemed appropriate to use a forward-looking distribution to code that accounted for the reduction in aerial feeder and an increase in buried feeder.

Staff discussed the modification of feeder distribution to code with SWBT. SWBT stated that even though they were reducing the amount of aerial copper feeder, it would never be zero because of physical conditions that required its use. To accomplish this Staff recommends a distribution to code for feeder that contains no more than 2% aerial copper feeder. The forward-looking distribution to code for fiber was adjusted to reflect the fact that SWBT does not use any aerial fiber cable. The buried and underground cable accounts were adjusted to reflect the reduction in aerial cable. The following table shows the existing and Staff proposed distribution to code.

Feeder Distribution to Code Percentages

Current Distribution to Code				
Rate Zone	**Aerial**	**Underground**	**Buried**	**Total**
Rural	**___**	**___**	**___**	**___**
Suburban	**___**	**___**	**___**	**___**
Urban	**___**	**___**	**___**	**___**
Staff Proposed Forward-Looking Copper Feeder Distribution to Code				
Rate Zone	**Aerial**	**Underground**	**Buried**	**Total**
Rural	2.00%	17.32%	80.68%	100.00%
Suburban	2.00%	42.87%	55.13%	100.00%
Urban	2.00%	83.76%	14.24%	100.00%
Staff Proposed Forward-Looking Fiber Feeder Distribution to Code				
Rate Zone	**Aerial**	**Underground**	**Buried**	**Total**
Rural	0.00%	19.81%	80.68%	100.00%
Suburban	0.00%	44.95%	55.13%	100.00%
Urban	0.00%	85.69%	14.24%	100.00%

Feeder Stub - The methodology that SWBT used to calculate the amount of feeder cable resulted in a double counting of the feeder stub. The feeder stub is a section of copper cable that connects the DLC to the FDI. To correct this problem, SWBT will subtract the length of feeder stub from the current segment on any loop that uses DLC.

Pole and Conduit Sharing - The loop cost models ignore pole and conduit sharing. SWBT provided data that indicated that currently about one percent of the conduit space and approximately six percent of the available pole space is shared with other entities. SWBT also stated that it and Union Electric regularly share poles but that sharing is not reflected in the **___** calculation. Instead, that sharing is implicitly contained in the pole investment report by SWBT. SWBT does not report pole investment as if it owned 100% of the poles in the network but instead reports an amount that reflects the fact the pole sharing exists with Union Electric. SWBT's inputs into the Hatfield Model 3.1 reflected 60% of the poles are shared with other companies. A similar amount of sharing is implicitly contained in SWBT's cost studies. The **___** pole sharing reported by SWBT accounts for sharing in addition to the sharing with Union Electric.

In considering the forward-looking pole and conduit sharing, it seems likely that in the near future, pole and conduit sharing will not increase dramatically. In the near term, most entrants into the local markets are expected to enter through resale or unbundled elements and provision their own loops using SWBT's poles and conduits. Therefore, Staff recommend that the investment in poles and conduits be adjusted to account for the current amount of sharing.

Pole and Conduit Investment - The methodology used by SWBT to determine the investment in poles and conduits is based upon historical investment ratios not the physical characteristics of the pole itself. The pole and conduit expense factors are based upon the historical investment in poles vs. aerial cable and conduit vs. underground cable to arrive at a factor that represents the investment in poles and conduit per dollar of investment in aerial and underground cable. This allocates more pole investment to cables with a higher pair/ft investment. Since cable size and installed pair/ft investment are inversely correlated, this factor applies more pole investment to smaller cables. This clearly does not match reality.

The modification that Staff proposes would be to determine the per pole investment, less any sharing, and multiply that times the average number of poles per aerial span to arrive at the average pole investment per aerial span. Once this cost is known, multiply it times a factor representing the number of working loops per pole to arrive at an average pole investment per cable pair. Multiplying the average pole investment times the number of working lines accounts for the space required for unused cable pairs on the pole. The pole investment per working cable pair is then input into the ACES model to arrive at the pole cost per month.

The adjustment for the conduit factor is identical to the pole modification. Like the pole calculation, the fiber fill factor would be built into the conduit factor to allow SWBT to recover the conduit investment associated with unused fiber. This would raise some concerns since the unused fiber is dark fiber and the investment associated with dark fiber can be recovered separately. A review of the dark fiber cost studies indicated that no conduit costs are being recovered through dark fiber so the issue of double recovery does not apply.

Additional Model Concerns That Cannot Be Modified At This Time

Feeder and FDI Termination - SWBT's loop models assume that each feeder segment terminates to only one FDI. SWBT determines the size of the feeder cable by the size of the FDI and then assumes the feeder segments has the same number of cable pairs because it connects directly to the FDI. In reality, a feeder segment may originate as a very large cable and taper as the cable terminates to multiple FDIs. SWBT's assumption will increase the cost of the feeder segment because it precludes the use of large size cable at the beginning of the feeder segment and fails to recognize the tapering of the feeder cable. SWBT's methodology would increase the number of smaller cables which have a higher cost per pair.

SWBT stated that it did not have any data related to the cable tapering and could not incorporate the tapering into the loop cost study. Given that no data exists, no modifications are possible. It is important to remember that SWBT's assumption of a single feeder cable terminating to an FDI will overstate the cable costs and overstate the cost of the loop.

Identical Distribution to Code for All Loop Types - The loop model assumes that all types of loops have the same percentage of buried, underground, and aerial cable. Since SWBT assumes DS-1 and ISDN-PRI loops have a copper/fiber cross-over at 6 kft and SWBT assumes that no fiber is aerial, it does not seem reasonable to assume the same percentage of aerial cable for a DS-1 loop and an 8 db loop.

SWBT stated that it did not have distribution to code data specific to each type of loop. Until such data is reported, no modification can be made. It is not clear what type of impact, if any, this modification would have on loop costs.

Summary of Loop Study

The loop cost study calculates the cost for 8 db loop, ISDN-BRI, DS-1 and ISDN-PRI loops. The study relies on the Loopvest model to calculate the investment for cable and the uses investment additives to calculate the investment for additional hardware necessary to provision each type of loop. Each of these items is discussed in more detail below.

Loopvest Model - Cable, Pole, and Conduit Section

Loopvest relies on a sample of loops by geographic zone to calculate the cost of the loop for that zone. Once the loop characteristics of the sample are identified, cost factors are applied to calculate the total installed cable investment for the loop. Once the installed investment for cable is determined, the investment required for poles and conduits is calculated by applying historic investments to the installed value of the cable.

Loop Sample - A sample for each rate zone is drawn by wire center for a total of three random samples. The size of the sample varies by geographic zone but is based upon the size necessary for a 95% confidence level. A sample is drawn from all loops and the same sample is used to determine the costs of all different types of loops: 8 db, ISDN-BRI, ISDN-PRI, and DS-1. Since the most prevalent loop is the 8 db loop, a random sample will tend to reflect the loop characteristics of an 8 db loop.

Sampling Implications - The sample is drawn from all loops and the same sample is used to determine the costs of all different types of loops: 8 db, ISDN-BRI, DS-1 and ISDN-PRI. Because the most prevalent loop is the 8 db loop, a random sample from all loops will tend to reflect the characteristics of an 8 db loop. To the extent that different types of loops have different physical characteristics than an 8 db loop, the costs of each type of loop will be incorrectly portrayed by SWBT's model. While there might not be a significant difference in the loop length for an 8 db loop and an ISDN-BRI loop, it is expected that, in general, DS-1 and ISDN-PRI loops tend to be shorter than a regular 8 db loop. SWBT recognizes the quality difference between 8 db loops and DS-1 loops by adjusting the copper/fiber cross-over point to 6 kft for DS-1 and ISDN-PRI loops. Since SWBT stated that it was uneconomical to use a 6 kft cross-over point for 8 db loops, the use of the 6 kft cross-over combined with a sample that reflects the length of a regular 8 db loop would overstate the true cost of DS-1 and ISDN-PRI loops. Since both DS-1 and ISDN-PRI loops are 4-wire loops, this overstatement is compounded when SWBT doubles the cost of a 2-wire loop to arrive at the cost of a 4-wire loop.

Identification of Cable Type - Once the sample is chosen, the total cable in each loop is divided into three categories; copper feeder, fiber feeder, and distribution cable. The distinction between each category is important because each has a different cost per foot as a result of different cable costs, fill factors and design and sizing criteria. In general, distribution cable has a higher investment per pair/foot than feeder cable.

Feeder Cable - Feeder cable is the cable that is placed between the Central Office and an FDI. The feeder is identified through engineering records by one of two methods. On 60% of loops, the feeder terminates to an FDI box and easily distinguished between feeder and distribution. The other 40% of the loops contain hard-splices that directly connect the feeder and distribution cable. In these cases, SWBT's engineering records place a theoretical FDI to identify points where feeder and distribution are joined. The placement of the theoretical FDI is subjectively determined by a facilities engineer at the time the loop is provisioned. One of SWBT's forward-looking assumptions is that in the future an FDI will always be used in joining feeder and distribution cable. Therefore, SWBT's cost studies reflect the cost of an FDI on 100% of the loops while in reality an FDI is only used in 60% of the loops. SWBT stated this assumption corresponds with SWBT current network design criteria. The assumption of 100% FDI placement will allow greater flexibility in the network and should allow SWBT to realize a higher fill factor on feeder cable.

The Loopvest model also assumes that a feeder cable will only terminate to a single FDI. In other words, there is one feeder cable running directly to every FDI. In reality, a feeder segment may originate as a very large cable and taper as the cable terminates to multiple FDIs. This assumption will increase the cost of the feeder segment because it precludes the use of large size cable at the beginning of the feeder segment and fails to recognize the possibility of tapering the feeder cable.

Once the feeder has been identified, it is separated into two groups, copper and fiber feeder cable. This is accomplished by the assumption of a 15 kft copper/fiber cross-over point for feeder cable in 8 db and ISDN-BRI loops and a 6 kft copper/fiber cross-over point for DS-1 and ISDN-PRI loops. In other words, the model assumes that all feeder runs in an 8 db and ISDN-BRI loop that are less than 15 kft are copper and that all feeder runs 15 kft or greater are fiber.

Assumed Copper/Fiber Cross-Over Point for Feeder Cable - For cost study purposes, SWBT has assumed a 15 kft copper/fiber cross-over point for 8 db and ISDN-BRI loops and a 6 kft cross-over point for DS-1 and ISDN-PRI loops. SWBT stated that this is a forward-looking assumption based upon current design criteria used by the company. SWBT has stated these points were chosen because they represent the most economical cross-over point between copper and fiber. The most economical cross-over point is based upon the trade-off between cheaper fiber optic cable and DLC equipment versus more expensive copper cable. SWBT submitted limited data to support the use of these cross-over points.

The most economical cross-over point generated by the Hatfield Model 3.1 is 9 kft. The difference between the two parties' most economical point is the price of the DLC equipment used on a fiber. SWBT reports a higher DLC cost and therefore requires a longer copper loop to offset the cost of the DLC equipment.

This assumption does represent a significant departure from the actual network in place today. For example, in the rural Rate Zone 3, this assumption results in over **___** of the feeder being provisioned with fiber optic cable while in reality only about **___** are currently provisioned with fiber.

Distribution Cable - After copper and fiber feeder cable are identified, the distribution cable is identified by subtracting the total feeder cable from the total cable in the sample. The determination of distribution cable is done by cable size so it reflects the fact that smaller cables are more prevalent in distribution cable that in feeder cable.

Inputs into Loopvest

Once the three categories and amounts of cable are identified, the installed investment per pair/foot for each category is identified for each type of placement (buried, underground, and aerial). After this has been done the inputs for fill factor, pole factor, and conduit factor are applied to the installed investment per pair foot for each cable. This is accomplished by using the following inputs into Loopvest.

Distance Distribution Bands - Because of various design criteria and requirements for different loop lengths, the loops are sorted and divided into 1 kft bands. For example, in copper cable, the wire size increases as the length of the loop increases. SWBT stated that dividing the loop into distance zones is the best way to recognize the different engineering requirements for various length loops.

Investment factors are then applied to the mid-point of the band. For example, all cable lengths between 1500 and 2499 ft. would be placed into a group and costs would be applied to the 2000 ft. mid-point. SWBT did not attempt to determine if the mid-point of each distance band was the same as the mean of the distance band. Our comparison of the mean and the mid-point indicates that the use of the mid-point overstates the length of cable in the sample. The amount of the overstatement appears to be statistically significant in a majority of the distance bands. SWBT agreed with this and proposed an adjustment to correct this problem.

Distribution to Code Percentages - This input measures the percentage of cable assigned to each type of placement. The types of placement for copper cable are aerial, buried, and underground while fiber is either buried or placed underground in conduit. The percentages used in SWBT cost studies are not forward-looking but are based upon historical placements in the existing loop. Using historical placement types may conflict with other forward-looking assumptions. SWBT's network witness, William Deere, testified that in a forward-looking network, SWBT would bury more feeder cable. This is not reflected in SWBT's cost models. An additional concern is that the same distribution to code percentages are used for all types of loops.

Once the necessary cable sizes and lengths are calculated from the distance bands and the amount of each placement type is determined the investment/pair foot is applied to compute the total cable investment.

Investment/Pair Foot - This is the average investment required for one foot of a cable pair. This is the primary investment input for the entire model. All other factors and inputs are applied to this input. The investment per pair foot is calculated for each cable segment (copper feeder, fiber feeder, and distribution) and for each type of placement (aerial, buried, underground). The investment per pair foot is weighted by the number of cable pairs of each size of cable. The source of the investment per pair/foot is the SWBT 1996 Outside Plant Broadgauge Report.

> **Investment/Pair Foot - Feeder** -The weighting for different cable sizes is based upon the size of FDIs used in the loop. Since an FDI is used only 60% of the time, the weighting is based upon 60% of the total feeder. This does not cause a problem if the distribution of cable size for feeder terminating to an FDI is the same as the distribution of cable size terminating to a hard splice. If the two distributions are different, this weighting will inaccurately reflect the weighted average investment per pair/foot.
>
> **Investment/Pair Foot - Distribution** - The weighted average investment per pair foot is calculated by subtracting the cost of feeder cable from the cost of all cable. The remaining cost per pair foot is assigned to distribution cable. The calculation is weighted by cable size and does recognize that distribution cable tends to be smaller and therefore has a higher cost per pair.

Fill Factor - The fill factor is the percentage of cable that is actually being used at the current time. In order to calculate the total cable cost per pair/foot including excess capacity realized by the fill factor, the investment per pair/foot is divided by the fill percentage to determine to the investment per pair foot including fill.

The fill factors used in SWBT's model are the actual fill factors in the existing loop. They differ by cable category (copper feeder, fiber feeder, and distribution) and by geographic zone. The following table depicts the fill by cable category and zone.

Fill Factors Used by SWBT

	Rate Zone 1	Rate Zone 2	Rate Zone 3	Statewide
Copper Feeder	**______**	**______**	**______**	**______**
Fiber Feeder	**______**	**______**	**______**	**______**
Distribution	**______**	**______**	**______**	**______**

It is important to remember that these fill factors are based upon the historical working pairs divided by the actual pairs in the loop today. They are not adjusted to be forward-looking nor do they recognize the increased utilization made possible by the use of higher depreciation rates.

Pole Factor - This factor is used to calculate the cost of poles used in aerial cable. The factor is applied to the investment per pair/foot times the total aerial pair feet in the loop segment. This factor is calculated based upon the ratio of total pole investment to the total historical aerial investment including fill. Both the pole and the aerial cable investment are adjusted to reflect the replacement cost of the investment by multiplying the book value of investment times the corresponding Current Cost/Book Cost Ratio (CC/BC Ratio). Even though the investment amounts are adjusted, this factor is based upon the replacement cost of SWBT's historic investment in poles and aerial cable.

Conduit Factor - This factor is used to calculate the cost of conduit used with underground cable. The factor is applied to the investment per pair/foot times the total underground pair/feet in the loop segment. This factor is calculated based upon the ratio of total conduit investment to the total historical underground cable investment including fill. Both the conduit and the underground cable investment are adjusted to reflect the replacement cost of the investment. Even though the investment amounts are adjusted, this factor is based upon the replacement cost of SWBT's historic investment in conduit and underground copper and fiber cable.

Like the pole factor, this method allocates the conduit investment based upon the investment in underground cable not by the physical characteristics of the cable it carriers. In addition, by including the fill factor in the equation, the same fill factor is built into the conduit investment. This is particularly troubling in the case of fiber optic cable where the fill factor is determined by the electronics on the end of fiber not by the excess fibers within the fiber optic cable. This results in all of the investment in conduit being recovered by the fibers currently in use without recognizing that the conduits also contain miles of dark fiber.

Implications of Pole and Conduit Factors - These factors allocate the conduit investment based upon the historic investment instead of by the physical characteristics of the cable it carriers. By including the fill factor in the equation, the same fill factor is built into the pole and conduit investment. This is particularly troubling in the case of fiber optic cable where the fill factor is determined by the electronics on the end of fiber not by the excess fibers within the fiber optic cable. This results in all conduit investment being recovered by the fibers currently in use without recognizing that the conduits also contain miles of dark fiber.

Additional Model Components

The additional model components are the additional equipment necessary to provision a working loop. This includes the electronics for providing digital circuits, termination equipment used to connect customers to the loop, as well as frame and other equipment used to connect the various loop segments.

Feeder Distribution Interface - As discussed earlier, one of SWBT's forward-looking assumptions is the use of a FDI in 100% of its loops. To recover the cost of the FDI, the model calculates the FDI cost per pair and assigns that to the loop investment. For 4-wire loops, the model doubles the per pair investment used in a two-wire loop.

Premise Termination - This component recovers the cost for the drop and the NID. The drop investment reflects a current mix of buried and underground drops. On a forward-looking basis, the prevalence of buried drops is expected to increase.

Feeder Stub - This component recovers the segment of feeder cable that connects the Digital Loop Carrier to the FDI. Currently, A feeder stub is used in both copper and fiber DLC. On a forward-looking basis, SWBT assumes there will not be DLC equipment used with copper.

The feeder stub costs are included in both the feeder segment and as a separate cost item. SWBT did agree that it was being counted twice and that it should be removed as a separate investment item. This is discussed in more detail in the Concerns and Suggested Modifications Section.

Digital Loop Carrier - This item recovers the costs for DLC which is a system that utilizes time-division multiplexing to combine individual channels into a common bit stream for transmission. On a forward-looking basis, DLC will only be used on fiber feeder segments greater than 15 kft. The type of DLC is specific to the geographic zone with larger systems used in dense urban areas and smaller systems used in the less dense areas.

The model assumes that on a forward-looking basis, **___** of the DLC will be integrated while the remaining **___** will be non-integrated universal DLC.

The DLC equipment used on the DS-1 and ISDN-PRI loops is also recovered through this additive.

Frame Stringer - The investment required for the Frame Stringer is recovered through this additive. It includes the investment in Frame and Lighting, Block & Riser, and the Spice [sic] and Place Cables.

ISDN-BRI Equipment - This investment is included in ISDN-BRI loops and includes the investment in loop hardware necessary to provision ISDN. It includes the Central Office Terminal and the Remote Terminal. Also included is the investment for a mid-span repeater. Because a mid-span repeater will only be necessary ** ____** of the time, only ** ____** of the investment is applied to the ISDN-BRI loop. Another option would have been to only include the investment in a mid-span repeater when it is actually used. This would be administratively harder to manage and would create the incentive for SWBT to use a mid-span repeater on every possible application. For this reason, applying a portion of the investment to each loop was chosen.

Summary

The loop cost study calculates the cost for 8 db loop, ISDN-BRI, DS-1 and ISDN-PRI loops. The study relies on the Loopvest model to calculate the investment for cable and uses the investment additives to calculate the investment for additional hardware necessary to provision each type of loop. This study generated several items of concern that warrant modification. Among those items were several that overstated the length of the loop and the use of existing fill factors and distribution to code that conflicted with other forward-looking assumptions made by SWBT. Additionally, this study calculated the cost of poles and conduits within the Loopvest model based upon historic investment relationships. Staff proposed a method for calculating pole and conduit investment outside of the Loopvest model that, while not perfect, accounts for the physical characteristics of the cables being place on poles or inside conduit. Finally, one area of concern that could not be addressed at this time was the assumption of a single feeder cable connecting to a single FDI. This assumption fails to recognize the economies of scale associated with the tapering of large cables and will overstate the investment in feeder cable.

Summary of the Cross-Connect Cost Study

Cross-connects consist of the distribution system equipment used to terminate and administer communication circuits. In a wire cross connect, copper jumper wires or patch cords are used to make circuit connections. In optical cross-connects, fiber optic patch cords are used. For SWBT's cross-connect cost studies, various scenarios are presented depending upon wire type and presence of testing equipment. The cost studies summarize the development of investment in cross-connect equipment and recurring and non-recurring costs associated with wire and optical cross-connects.

Purpose

The cross-connect cost study identifies the forward looking long run incremental recurring and non-recurring costs for the unbundled cross-connect. The study consists of the transmission equipment required to cross-connect the SWBT main distribution frame (MDF) to interconnector designated equipment.

Concerns

SWBT has agreed to provide cross-connects with and without test equipment depending upon CLEC preference. In the case a CLEC does not wish to purchase a loop with test equipment, SWBT asserts it cannot be held to the same standards as if the testing equipment were used. A standard reflecting manual testing should be developed.

Summary

Costs derived for cross-connects consist of monthly recurring costs per cross-connect and non-recurring costs for installations and disconnections. Like all other costs for SWBT's network elements, costs are derived based on investment. Recurring costs for cross-connects consist of the monthly costs of the following cross connects:

- 2 wire analog / BRI cross-connect with test equipment
- 2 wire analog / BRI cross-connect without test equipment
- 4 wire cross-connect without test equipment
- 4 wire cross-connect with test equipment
- 2 wire analog cross-connect to multiplexer plug
- 4 wire analog cross-connect to multiplexer plug
- 2 wire BRI cross-connect to multiplexer plug

- Simple DS-1 cross-connect without test equipment
- 4 wire DS-1 cross-connect with test equipment

In short, the costs are developed for cross-connects from the equipment needed to meet the technical parameters of the cross-connect element. The designs consist of transmission equipment configurations for various cross-connect scenarios. The cross-connect scenarios involve cross-connects from the MDF to a collocator's cage and cross-connects from the MDF to a SWBT multiplexer. Cross-connects for a 2-wire, 4-wire, and 2-wire BRI loop were developed for each scenario. Costs were also determined for DS-1, DS-3, and Optical cross-connects. Investment values were determined from the material needed for a cross-connect and fed into ACES where monthly recurring costs are derived.

Non-recurring costs for cross-connects are related to the installation and disconnection of a cross-connect. Non-recurring costs for cross-connects refer to the expenses labor efforts required to provide service to a customer. Non-recurring costs do not include costs associated with maintaining or repairing the service.

Identifying non-recurring costs entail identifying workgroups involved in installing and disconnecting cross-connects, identifying job functions required to perform the install/disconnect, identifying labor time, and identifying labor rates. Included in the non-recurring costs for cross-connects are costs associated with the business service center, circuit provisioning center work, procurement, inventory control, central office forces, and special service center work. The business service center conducts negotiations and handles service orders. The circuit provisioning center provides circuit design and identifies necessary transmission equipment required to meet circuit parameters. Procurement handles the logistics of shipping equipment. Inventory control handles the administration and tracking of plug-in circuit equipment. Central office forces handle the installation and disconnection. Special service center costs are associated with I&M installation activity and remote testing.

Investment for cross-connects is not identified through a complicated models like the loop elements, switching, or interoffice transport, but is identified through simple formulas. The formula used depends upon the piece of equipment involved. For 2 wire BRI cross-connect to multiplexer plug, 2 wire analog cross-connect to multiplexer plug, and 4 wire analog cross-connect to multiplexer plug, the following series of formulas were used to identify investment:

Formula 1: Circuit Plug-in

Placement Cost = Material Cost * Sales Tax

Power Cost = (Placement Cost + Material) * Power Factor

Total Investment = Material + Placement Cost + Power Cost

Unit Investment = Total Investment / (Capacity * Utilization),

where utilization is a fill factor and capacity is the physical limit of the equipment.

For 2 wire analog / BRI cross-connects, 4 wire cross-connects with test equipment, and 2 wire analog / BRI cross-connects without test equipment the following series of formulas were used to determine investment:

Formula 2: Hardwired 57c (Central Office Equipment)

Placement Cost = Material Cost * 57c Hardwired In-Place Factor
Power Cost = Placement Cost * Power Factor
Total Investment = Placement Cost + Power Factor
Unit Investment = Total Investment / (Capacity * Utilization).

For the components that make up a DS-1 cross-connect, DSX-1 and DTAU[2]-hardwired, formula series number two is used. For the remaining component, DTAU-plug in, the following series is used:

Formula 3: Common Plug-In

Placement Cost = Material Cost * Plug-In 57c In- Place Factor
Power Cost = Placement Cost * Power Factor
Total Investment = Placement Cost + Power Cost
Unit Investment = Total Investment / (Capacity * Utilization).

Once investment is identified, CAPCOST is used to identify the capital costs associated with the equipment. Unit investment for each piece of equipment is plugged into ACES where annual and monthly costs are identified.

[2]DTAU - Digital Test Access Unit

SWITCHING COST INFORMATION SYSTEM

This report describes the SCIS Intelligent Network (SCIS/IN) and SCIS Model Office (SCIS/MO) models, and identifies our concerns and recommendations. This report is divided into two sections: SCIS/IN and SCIS/MO. Because SCIS/MO produces outputs which are fed into the SCIS/IN model as well as other cost studies, the majority of this report will focus on the SCIS/MO model. The SCIS/MO report is divided into the following sections: (1) Purpose; (2) Concerns and Recommended Modifications; (3) Summary Recommended Modifications; (4) Description; and (5) Inputs.

SECTION I - SCIS/IN

Purpose

Switching Cost Information System Intelligent Network (SCIS/IN) is a feature costing program that utilizes vendor tables, results of SCIS/MO studies and feature specific inputs and algorithms to calculate investments for various network services. SCIS/IN can be used to determine investment for vertical services and special assemblies (e.g., individual case based services requiring special pricing).

As with SCIS/MO, SWBT runs SCIS/IN in the average mode. SCIS/IN is used in the cost studies to determine investment for DS1 trunk ports, Basic Rate Interface (BRI) and Primary Rate Interface (PRI).

Staff does not propose any modifications be made to the SCIS/IN studies.

SECTION II - SCIS/MO

Purpose

SCIS/MO is an engineering-based economic model, developed by BellCore, that identifies investments for switching services. SCIS/MO produces switching investment which is utilized in numerous SWBT TELRIC studies, such as local switching, tandem switching, etc. SCIS/MO uses a building block approach by dividing a switching system into functional categories, assigning each switch equipment component to one or more categories and developing an investment per unit of use of the function.

Concerns and Recommended Modifications

In July, 1992, Arthur Anderson & Company performed an independent review of the SCIS model as part of an Open Network Architecture tariff proceeding before the FCC. After conducting an extensive review, Arthur Anderson concluded the SCIS model was fundamentally sound and provides reasonable estimates of switching system investment attributable to service and feature usage of the switch. Further, Arthur Anderson determined the costing principles inherent in SCIS/MO are appropriate for estimating long run incremental investments attributable to switching system usage, and the specific methods for implementing these principles are reasonable. In its study, Arthur Anderson identified certain "key levers" which have a substantial impact on the model results. Among those identified were vendor discounts, cost of money and others.

Arthur Anderson's review of the SCIS/MO model reinforced Staff's belief that the SCIS/MO model is essentially a solid model. Therefore, Staff attempted to primarily examine those inputs that had substantial impacts on the investment, and those inputs that appeared unreasonable. The following section identifies our primary areas of concern and/or recommended modifications with SWBT's inputs to the SCIS/MO model and/or related models, which are as follows: (1) vendor discounts; (2) analog switch exclusion; (3) tandem/end office double counting; (4) COM; (5)line count; and (6) SS7.

Vendor Discounts

SWBT, AT&T and MCI negotiate discounts off list prices for material, engineering and installation for switching equipment with various switch vendors. These discounts are considered by these companies and the switch vendors to be confidential. Because these discounts involve information deemed confidential by the vendors that are not a party to this case, the actual amount of the discounts received or proposed by SWBT, AT&T,

MCI were presented in this report. Staff has provided the Commission with a detailed analysis which does contain firm specific discounts information.

Staff reviewed discounts used by SWBT in the SCIS/MO cost studies. Staff believes SWBT is receiving discounts in addition to those used in SWBT's original cost studies. To determine a more complete discount, Staff reviewed vendor contracts, Firm Price Quotes (FPQ) which are prices for a specific job, and purchase orders. Based upon the review of these documents, Staff proposed different discounts for both Nortel and Lucent switches. SWBT also purchases switches for Ericsson but Staff did not propose to modify the Ericsson discounts.

Staff believes SWBT may receive additional discounts on the Ericsson switches. However because of the limited number of Ericsson switches employed in SWBT's network and that Staff believes the additional discounts, if any, are minimal, Staff is not proposing any adjustment.

Staff does propose to modify the discounts for both Lucent and Nortel switches. Staff believes that SWBT receives significant additional discounts for both Lucent and Nortel switches than was originally used in the SCIS/MO model. The modified discounts proposed by Staff are based upon a review of FPQ's for growth jobs. Staff feels these are conservative estimates of the discounts SWBT receives. Historically, it has been widely acknowledged throughout the industry that the discounts for growth jobs are typically less than the discounts for new switches. Recent information indicates that trend may be changing throughout the industry so that new switch purchases and growth jobs receive the same discount. Regardless, Staff is certain the discount on growth jobs is no greater than the discount on new switch purchases and believes these to be conservative estimates.

Finally, the discounts proposed by Staff only apply to materials. Staff's review of contracts and FPQs could not confirm whether or not SWBT receives discounts on engineering and installation. Staff does note that it appears that other firms receive discounts on these items.

During the cost study review, Staff received switch discount information from AT&T for Lucent switches. Because of the possibility that AT&T may receive a higher discount than any other company because of its relationship with Lucent and because of some language contained in AT&T - Lucent contract, Staff does not believe it is appropriate to recommend the use of AT&T's discounts in SWBT's cost models.

In summary, the discounts Staff proposes are reasonable, based on actual purchase orders and FPQs, and considerably more indicative of actual prices paid by SWBT than the existing discount levels in the SCIS/MO studies. Further, Staff believes the recommended discounts are conservative, based on the fact that SWBT's resulting investment per line is still greater than that which Staff believes is standard in the industry, based on the fact that the discounts are extracted from growth jobs. Finally, engineering and installation discounts are not being recommended.

Analog Switch Exclusion

Although SWBT currently has 24 1A ESS analog switches (12 end office and 12 combination tandem/end office) in Missouri, their resulting investment and line counts are excluded from the local switching study. SWBT will eventually replace the 1A ESS switches with DMS-100/200 and 5ESS switches. The 1A ESS switches are primarily located in high density urban areas, thus having a lower investment per line. Our concern in this regard is that excluding the 1A ESS switches from the study will increase the investment per line (most prevalently in the urban zones) by failing to take into account those efficient, high line count switches.

In order to compensate for this, Staff recommends that SWBT perform a forward looking replacement of all 1A ESS switches in the SCIS/MO model with DMS-100 and 5ESS switches. In discussions with SWBT in this regard, a company official created a "replacement list" of 5ESS and DMS-100 offices for the analog offices. Essentially, 24 existing digital offices with similar characteristics will be used in the SCIS/MO studies in place of the excluded analog switches. Staff has reviewed the list and believes the replacement offices are appropriate.

Tandem/End Office Double Counting

Certain switches used by local exchange carriers serve as both tandem and end office switches (Class 4/5 switches). Currently, SWBT has 10 digital and 12 analog Class 4/5 switches in use. The investment for these switches is undisputedly double recovered in the tandem and local switching studies because of the switches dual functionality. For example, processor and SS7 functionality is utilized in local and tandem switching applications. Further, tandem trunk investment is also recovered in both the tandem and local switching studies. In order to compensate for this double recovery, we propose the following solution: (1) for tandem/end office switches, completely remove the tandem trunks from the SCIS/MO model runs which are fed into the local switching study; and (2) for the tandem/end office switches, reduce the getting started investment and SS7 investment by the ratio of local to (tandem + local) minutes of use. Performing this calculation will reduce processor and SS7 investment appropriately by removing the investment associated with tandem use. The aforesaid adjustment should be performed on Class 4/5 offices which are utilized in the local switching study.

Cost of Money

The SCIS/MO model contains a window to input the COM used; SWBT used 10.69%. COM is used to determine present-worth investment when switch additions/modifications are performed at a later date. Consistent with our recommendation with regard to cost of capital, SWBT should utilize a 10.36% COM in the SCIS/MO calculations. As noted previously, the effects of modifying the COM in the SCIS/MO studies are minor.

Line Count

The line and trunk count data utilized in the SCIS/MO studies is not forward looking. In order to maintain consistency with other forward looking assumptions, it Staff's recommendation that line counts be forward looking to account for two years of growth. Actual data used in the SCIS/MO studies is from June, 1996. Therefore two year growth adjustment will estimate line counts as of June, 1998. In some instances this adjustment will reduce per line investment; in other instances an increase in per line investment could be realized when equipment capacity is exceeded and must be increased (for example a Nortel DMS-100 with a growable processor). According to a SWBT official, the recommended line count growth was not substantial enough to have major impacts upon trunk counts. Therefore, trunk counts were not adjusted.

SS7

As discussed above, SWBT uses the link mode in the SCIS/MO studies to determine SS7 investment. For many of the offices in the study, it appears that SS7 utilization is understated (a SWBT official also confirmed this). The utilization which can be adjusted in the model is the utilization of the A link, or the SS7 link connecting the end office to a signal transfer point (STP). It is our recommendation that the utilization on this link be modified to reflect normal growth and to take into account the increased utilization produced through number portability implementation. Specifically, number portability implementation will result in increased utilization of A links, D links (transmission paths connecting regional and local STPs). Therefore, we recommend link utilization in the SCIS/MO model be 0.4613. This utilization assumes a 10% growth on existing utilization per year, plus 2.5 times the resulting growth figure. The 2.5 multiplier is applied to adjust for increased utilization due to number portability. This recommendation is consistent with our link utilization recommendation in the SS7 report, which is fully described in the link utilization section.

Summary of Recommendations

The SCIS/MO model is a complex, proven model with a substantial number of inputs. A thorough investigation into the validity of every input would necessitate additional time. However, Staff believes it has examined the major inputs and recommended modifications where necessary. Specifically, Staff recommends the following modifications be made to the SCIS/MO studies:

Discounts	Modified to reflect discounts contained in FPQ's and Purchase Orders for growth jobs.
Analog Switch	SWBT shall perform a complete 24 office analog switch replacement.
Double Counting	SWBT shall eliminate Class 4/5 double counting through deletion of tandem trunk investment, and reduction of getting started and SS7 investment by the ratio described above.
COM	COM shall be modified to reflect 10.36%.
Line Count	SWBT shall utilize forward looking line counts as described above.
SS7 Links	SWBT shall utilize a forward looking SS7 link utilization as described above.

Description of SCIS/MO Model

If desired, SCIS/MO can be used to produce costs by including annual cost factors, however SWBT uses SCIS/MO to produce investment, then runs the investment through its ACES model to determine costs. SCIS/MO calculates a standard set of investment primitives for each switching center. The calculations may be performed in either marginal or average mode; SWBT uses the average mode. SCIS/MO can also be used to support LEC business decisions, such as in a profitability analysis, contribution analysis and new service analysis. SCIS/MO produces results which are accurate to +/- 2%. SCIS/IN utilizes investment outputs from the SCIS/MO model.

Inputs

SCIS/MO utilizes the most recent equipment investment inputs; this information is not user adjustable and is supplied from vendors to BellCore. Following is a summary of SCIS/MO inputs which are adjustable. System defined inputs are user changeable and include the following categories: (1) Discounts; (2) Marginal Options; (3) SS7 Services;(4) Automatic Message Accounting (AMA) Assumptions; (5) Plain Old Telephone Service (POTS) Assumptions; and (6) Integrated Services Digital Network (ISDN) Assumptions. Cost of Money (COM) can also be adjusted at the system level. The aforesaid input categories apply to all the offices in the study unless office specific input categories are assigned to override. Office specific inputs include the following categories: (1) office input; (2) general; (3) central processor unit (CPU)/getting started investment (GSI); (4) processor utilization factor (PUF); (5) GSI adjustments; (6) switching module processor; (7) lines/trunks; (8) SS7; (9) ISDN; (10) TR303; (11) AMA;

(12) Remotes; and (13) link peripheral processor (LPP). Following is a description of both system defined and office specific inputs.

System Defined Inputs

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